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ABSTRACT

The issues involving the role and impact of specialists and generalists in society are critically examined in this paper. Currently held views on specialization are analyzed and challenged. Perspectives on this dilemma are developed in the following areas: (1) limitations of experts (casts doubt on the assumption that ordinary citizens are incompetent by citing historical cases of individuals who altered the dogma of experts); (2) new technical means--innovation and invention (provides examples of inventions that occurred from those outside the recognized establishment especially in the aviation and computer fields); and (3) leadership and governance (reviews accounts of how various institutions and organizations have accommodated change brought about by outside influences). Recommendations include establishment of a liberal education at all levels and a re-examination of the extensive emphasis on vocational and professional education and learning. (ML)

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XX CLUB OF MORGANTOWN, WV

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Of Specialists and Generalists
Paul W. DeVore
May 1984

At the conclusion of World War II and with the formation of the United Nations most people throughout the world had high hope that civilization had reached a new level of maturity and responsibility and that the world would be more stable, less violent and more likely to evolve toward peace and human equality. Today we are less sure our hopes will come true. Each day brings not only political crises but crises related to the very social and technological systems that provide for our basic needs.

The crises have been evolving for some time, they are not of recent origin. We can search for many reasons as to why we have created an unstable, more violent world. Perhaps John Gardner, writing in the Annual Report, 1965 of the Carnegie Corporation of New York, provided us with some insight when he suggested that our evolving crises were the result of fragmented leadership, leadership that fails to deal with the essential human questions of all time, questions that cut across specialities such as: Where are we headed? Where do we want to head? What are the major trends determining our future? Should we do anything about them? (1, p. 70). In a similar but alternative way we can individually and collectively alter our fragmented

approach to solving our problems by returning to the basic questions concerning reality: Who are we? Why are we here? Where are we going? How will we get there? I submit we have been focusing almost entirely on the question of how we will get there, a means question, rather than the critical questions that place our means in perspective and because of this have created for ourselves a set of problems for which we have few answers. There are many problems that have been identified. For the purpose of my exploration of the issue of specialists and generalists in society I have selected a list developed for the Trend Analysis Program (TAP) of the American Council of Life Insurance by the Futures Group of Glastonbury, Connecticut. Their task was to examine the potential for large scale catastrophic events in the near future (9, p. 7).

Five crises were identified: (i) the warming of the earth's atmosphere with noticeable effects in the 1990s by increasing industrialization in the world and increasing population; (ii) the water shortage disaster in much of the world already affecting personal health, agriculture, industrial processes, energy conversion and the extraction and processing of resources; (iii) the collapse of the physical infrastructure meaning the decay of roads, bridges, railroads, water and sewage systems, dams, public buildings,

and energy conversion systems; (iv) the global financial crisis related to taxpayer resistance locally and federally, the continued decline of the infrastructure in developed countries and the dramatic growth in recent years of worldwide economic interdependence coupled with trade deficits and the prospect of a general economic collapse brought about by a major debt default by Mexico, Brazil, and/or Argentina, and (v) the threat of nuclear war brought about by deteriorating United States and Soviet relations related to regional conflicts in the Middle East, Southeast Asia, the Caribbean and the Indian subcontinent, as well as the potential of terrorist groups such as the Japanese Red Army, the Red Brigades, the Popular Front for the Liberation of Palestine, Black September and the FLN to be able to assemble a nuclear device (9, pp. 9-19).

No longer do we seem to be in control of our destiny. Even at local and regional levels we have, by our collective actions, created an inhospitable social order where unemployment is an accepted norm, where child abuse is all too evident, where alcoholism and other drug abuse is rampant, where people at all levels of society seem frustrated and alienated, where destruction of the life-giving and life-sustaining environment continues throughout the world with related health problems and where the sense

of true community has seriously declined and where interpersonal relations have been reduced to daily confrontations.

It is interesting to find on examination of these crises that the number, magnitude and seriousness of our problems have increased at a time when there are more scientists, technologists, political scientists and other experts and specialists than ever before.

Perhaps herein lies the problem. Have we professionalized and specialized to such an extent that we no longer are capable as citizens in performing our civic duties and responsibilities to engage and solve the complex multi-discipline problems of our times? Have we specialized ourselves to such a level we are no longer capable of designing social and technological systems capable of serving our social and human purposes rather than destroying them? Have we left too many of our critical decisions to the minds of specialists? I submit that, on examination, we will find there is considerable truth to this possibility.

The Limitation of Experts

We seem to have concluded in individual but collective ways that we should leave the major decisions to specialists in fields such as health care, legal matters, finance,

governance, architecture, transportation, education, energy policy, agricultural policy and urban renewal, among others. The assumption by many has been that ordinary citizens are incompetent and their judgments faulty. This view predominates where the concern is with immediate solutions to problems and short term answers. But the view is being questioned by the lay citizen as well as the experts. Harold J. Laski believes "it is one thing to urge the need for expert consultation at every stage in policy making and quite another thing and a very different thing to insist that the experts' judgment must be final." Laski believes that "expertise sacrifices the insight of common sense to intensity of experience" and that it "breeds the inability to accept new views from the very depth of its preoccupation with its own conclusions" (1, p. 51). Specialists and experts evidence "a certain caste-spirit" which tends to reject all experience or evidence alien to their own group.

There are many examples over the centuries of this rather arrogant dogmatism; William Harvey's proof that the anointed expert, the Greek physician Galen was wrong about the circulation of blood, Nicolas Copernicus' questioning of Ptolemaic theory on the relation of the Earth to other planets, the Wright Brothers' rejection of flat plane theory for flight, the creation of the

transistor by Walter Brattain, John Bardeen and William Shockley despite the fact the scientific expertise of the time believed there was nothing more to be known or found in the field of solid state materials. Other examples of individuals who altered in their day the dogma of experts include Edward Jenner and vaccination, Charles R. Darwin and the theory of evolution and Lewis Pasteur and fermentation and living organisms. More recently we have seen movements and breakthroughs in thinking in energy conversion and conservation primarily in solar energy and housing, food, nutrition and health, wholistic health care, the importance of small business and industry in developed and developing countries, parenting, birthing and the recognition that a healthy natural environment is directly related to the health of people and the long term sustainability of our communities. In each of the cases cited, the experts and specialists of the time lacked the flexibility of intellect when they approached the parameters agreed upon by their speciality. This apparently occurs in all human activities. An example of the limitations of specialists in industry in the past century which has similarities to recent events in our optical, automobile, graphic arts and electronics industries involved the then new Bessemer process for steel making. Elting Morrison relates the story.

> In the years from 1864 to 1871 ten steel companies in this country (the United States) began making steel by the new Bessemer process. All but one of them at the outset imported from Great Britain English workmen familiar with the process. One, the Cambria Company, did not. In the first few years those companies with British labor established an initial superiority. But by the end of the seventies, Cambria had obtained a commanding lead over all competitors. The President of Cambria, R. W. Hunt, in seeking a cause for his company's success, assigned it almost exclusively to the labor policy. "We started the converter plant without a single man who had ever seen even the outside of a Bessemer plant. We thus had willing pupils with no prejudices and no reminiscences of what they had done in the old country." The Bessemer process, like any new technique, had been constantly improved and refined in this period from 1864 to 1871. The British laborers of Cambria's competitors, secure in the performance of their own original techniques, resisted and resented all change. The Pennsylvania farm boys, untrammeled by the rituals and traditions of their craft, happily and rapidly adapted themselves to the constantly changing process. They ended by creating an unassailable competitive position for their company (8, p. 40).

New Technical Means--Innovation and Invention

The Pennsylvania farm boys had what Jewkes and others have identified as the "uncommitted mind." They found in their study of the sources of inventions that nearly all the important inventions in steel production in the nineteenth century came from rank outsiders . . . . (8, p. 96). There are numerous examples of this being the case in other fields also. According to Farnsworth he was given four reasons by his professors why his ideas

about television would not work. Amateur short wave radio experimenters were not deterred by the prevailing mathematical proofs of the time that short wave radio was impossible, and C. F. Carlson, inventor of xerography, was told by his technical friends that he was wasting his time (6, p. 97).

Recent developments in aviation clearly illustrate the role of these outside the anointed establishment in bringing about fresh approaches to current problems. Burt Rutan, for instance, working out of a small hangar in the Mojave Desert has revolutionized thinking in aviation with the canard wing for aircraft. Even NASA and the military have adopted the concept as well as Beech aircraft in the development of the Starship. The Beech Starship, for which Rutan consulted, holds the promise of revolutionizing the business aviation industry.

Another example is the work of Thomas Stoddard, founder of Stoddard Hamilton at the age of 22. He has changed the way people think about building aircraft by designing a high speed single-engine aircraft using epoxy resin fiber reinforced structures. The Glasair, using the fiber structure, cruises at 204 knots (236 MPH) using 10 gallons of fuel per hour (23.6 mpg at 236 MPH).

Currently many examples are coming from the computer industry which has been revolutionized the last ten years, not only because of the advent of integrated circuits of great magnitude but because of rank outsiders who created the personal microcomputer. Additionally, young men and women few had heard of created the software that enabled the average citizen to purchase and utilize computing capacity that only a few short years ago was the domain of an elite group of mainframe specialists. Bill Gates and Paul Allen of Microsoft, and Michael Wise of Borderband Software are examples of the creators of the new era.

The problem with experts and specialists, according to Jewkes, is that (i) they come to accept traditional interpretations of events and (ii) they become insulated from each other (6, p. 98). They become blind to the total the same as the six men of Indostan were when they examined the elephant.

THE BLIND MEN AND THE ELEPHANT
A Version of the Famous Indian Legend
By John Godfrey Saxe
(1816-1887)

It was six men of Indostan
  To learning much inclined,
Who went to see the Elephant
  (Though all of them were blind),
That each by observation
  Might satisfy his mind.

The First approached the Elephant,
  And happening to fall
Against his broad and sturdy side,
  At once began to bawl:
"Bless me! but the Elephant
  Is very like a wall!"

The Second, feeling of the tusk,
  Cried, "Ho! what have we here,
So very round and smooth and sharp?
  To me 'tis mighty clear
This wonder of an Elephant
  Is very like a spear!"

The third approached the animal,
  And happening to take
The squirming trunk within his hands,
  Thus boldly up and spake:
"I see," quoth he, "the Elephant
  Is very like a snake!"

The Fourth reached out his eager hand,
  And felt about the knee.
"What most this wondrous beast is like
  Is mighty plain," quoth he;
"'Tis clear enough the Elephant
  Is very like a tree!"

The Fifth, who chanced to touch the ear,
  Said, "E'en the blindest man
Can tell what this resembles most;
  Deny the fact who can,
This marvel of an Elephant
  Is very like a fan!"

The Sixth no sooner had begun
  About the beast to grope,
Than, seizing on the swinging tail
  That fell within his scope,
"I see," quoth he, "the Elephant
  Is very like a rope!"

And so these men of Indostan
  Disputed loud and long,
Each in his own opinion
  Exceeding stiff and strong,
Though each was partly in the right,
  And all were in the wrong!

--McGraw-Hill Book Company, New York, 1963

Leadership and Governance

Today, not only in business, industry and education but perhaps more so in government we have built a system of experts that seem to create problems rather than solve them. We seem to have too many blind experts.

What kind of person should we seek to provide us with leadership in a time of increasingly critical problems that in many ways threaten the very existence of civilization as we know it? Shall we seek to improve our experts or even create counsels of experts to provide us with answers to our specialized social and technological problems? Laski advises against this. He believes that a cabinet of experts would never devise great policy because their competing specializations would clash and their "intensity of vision would destroy the sense of proportion." He reminds us that progress in naval disarmament does not occur when admirals confer, legal progress does not come from Bar Association meetings, education reforms from congresses of teachers, governmental reform from politicians, nor health care reform from the medical profession (1, p. 55). Change in these institutions and fields most often is forced from the outside with rather peculiar forms of institutional adoption sometimes following the changes.

It is interesting to review accounts of how various institutions and organizations have accommodated change

brought about by outside influence. One example comes from mechanization of a British light artillery unit in World War II, as told by Elting Morrison.

> In the early days of the last war when armaments of all kinds were in short supply, the British, I am told, made use of a venerable field piece that had come down to them from previous generations. The honorable past of this light artillery stretched back, in fact, to the Boer War. In the days of uncertainty after the fall of France, these guns, hitched to trucks, served as useful mobile units in the coast defense. But it was felt that the rapidity of fire could be increased. A time-motion expert was, therefore, called in to suggest ways to simplify the firing procedures. He watched one of the gun crews of five men at practice in the field for some time. Puzzled by certain aspects of the procedures, he took some slow-motion pictures of the soldiers performing the loading, aiming, and firing routines.
>
> When he ran these pictures over once or twice, he noticed something that appeared odd to him. A moment before the firing, two members of the gun crew ceased all activity and came to attention for a three-second interval extending throughout the discharge of the gun. He summoned an old colonel of artillery, showed him the pictures, and pointed out this strange behavior. What, he asked the colonel, did it mean. The colonel, too, was puzzled. He asked to see the pictures again. "Ah," he said when the performance was over, "I have it. They are holding the horses" (8, pp. 17-18).

If we are to enter the 21st century with a reasonable assurance that we can solve our problems, we must find answers to questions related to leadership and governance. How shall we select our leaders? What is the best education for our citizens? Our leaders? How shall

we utilize experts and specialists? What is the role of citizens?

In today's world there are many who have cited the clear dangers in trusting our public policies and our futures to a scientific or technological elite. Dwight Eisenhower and C. P. Snow each warned against the danger; primarily because they were concerned about the restricted perspective of the specialist and the isolated and insulated knowledge of specialized fields (1, p. 69). George Orwell in his novel 1984, perhaps more than anyone else, brought to the attention of the ordinary citizen the problems of a specialized society that placed men above law. George Orwell's political novel was written for the same reason Jacque Ellul wrote The Technological Society, to awaken the sleeper.

Many of the problems of today are the result of restricted thinking, of our inability to comprehend the fact that our world is a natural and human world and that no matter what technical systems are devised by experts it should be people, individually and collectively, who determine the nature of the system of governance and the characteristics of our technical systems. To exclude the citizens from the decision because the experts consider them uneducated and unable is the road to rule

by the interest of specialists; it is the road to 1984. Yet, it seems this is the road many are choosing, a society ruled by specialists or by managers in George Orwell's terms.

The logical outcome of government by managers is extreme centralization and a world where there are no fixed eternal realities. Realities become confused as in 1984 where War was Peace, freedom slavery and ignorance strength. Rule by managers is a way of life where society and humans are fragmented, where rather than a government of laws, we succumb to governance by men where the bottom line is thought control.

Today neither our managers or our citizens are prepared to address and solve the problems facing us, whether they concern peace, our infrastructure, water, energy, food, interpersonal relations, crime, corruption, employment or balance of trade.

How shall we prepare ourselves to address the numerous problems of seemingly insurmountable magnitude? As a first step I suggest we evaluate how we educate ourselves. The problem of education goes well beyond quality basic education and literacy in the usual understanding of these aspects of education. It goes beyond the question of general or specialized education.

Both are required. The examination of education must focus on the preparation of citizens knowledgable about the behavior of natural, social and Technological systems and their relationships. We must become more knowledgable about the design and operation of these systems so we can provide for all citizens meaningful, healthful and quality lives.

This new focus implies a new form of liberal or basic education at all levels and a re-examination of our extensive emphasis throughout our education system on vocational and professional education and training. We must seek a better balance and recognize that the preparation of a citizen requires far more than preparation for the world of work and economic sector responsibilities. Our shortcomings are in our civic responsibilities.

If we do not accept the responsibility to prepare ourselves to govern ourselves effectively our great cadre of scientific, technological and humanistic specialists of various callings will be of little use except to increase the probability they will create more problems and crises and perhaps, eventually, the destruction of life as we sometimes contemplate it.

The issue I raise is not new, only more serious today than in other eras. Alfred North Whitehead in his Lowell

Lectures in 1925 warned us of the dangers of specialization and professionalism. He was concerned about the dangers of educating "minds in a groove" and preparing people that would treat life outside their professions or specialities in a superficial way. He believed that the dangers arising from the specialization and professionalism of education were great, particularly for democratic societies.

Whitehead did not deny that the specialized functions of a community would be performed better. There would be more perfectly formed loaves of bread, better sewers, telephone service and police protection. Yet, his concern was that the "generalized direction" of society would lack purpose and direction (1, p. 47).

He reminded his audience that "when you understand all about the sun and all about the atmosphere and all about the rotation of the earth, you may still miss the radiance of the sunset" (1, p. 49).

And to this I would add: We can know all about the atom, all about the pancreas, all about libel law, all about bridge structures, all about Victorian poetry, all about the stock market, all about internal combustion engines, all about sheep raising, and all about any other single topic large or small, and fail to comprehend human reality.

The professionalizing and vocationalizing of our universities has fostered the belief that the only real and useful knowledge is that which is fragmented, segmented and specialized and that only those "qualified" by a university degree or anointed through certification by a specialized group are capable of seeking or knowing the truth.

Seeking Direction

Somehow we must find a new tack, a new direction, a new star for guidance. The new direction may be an old direction, the return to contemplation and reflection on the basic questions of all time; those concerning truth, reality and love.

> You see things as they are and ask "Why?"
> But I dream things that never were: and
> ask "Why not?"
>
> George Bernard Shaw

REFERENCES

1. Committee on National Security and International Operations. Specialists and Generalists: A Selection of Readings. Washington: U. S. Government Printing Office. 1968.

2. DeVore, Paul W. Technology: An Introduction. Worcester, MA: Davis Publications, Inc. 1980.

3. Haavind, Robert. "Quicker solutions to national problems." High Technology. May 1984, p. 2.

4. Hallion, Richard P. The Wright Brothers: Heirs of Prometheus. Washington: Smithsonian Institution Press. 1978.

5. IBM. Leonardo da Vinci. New York: International Business Machines Corporation. 1951.

6. Jewkes, John; Sawers, David and Stillerman, Richard. The Sources of Invention. New York: W. W. Norton and Company, Inc. 1968.

7. Miller, J. Jefferson. "Glasair." AOPA Pilot. March 1984, pp. 27-33.

8. Morrison, Elting E. Men, Machines and Modern Times. Cambridge: MIT Press. 1966.

9. Neufeld, William P. "Five Potential Crises." Futurist. April 1984, pp. 9-19.

10. Orwell, George. 1984. New York: New American Library. 1949.

11. Stout State College. Grappling With Ideas. Menomonie, Wisconsin. 1962.